

CLAIMS

1. A substrate holding device which holds a substrate to be exposed through a liquid, comprising:
a holder which holds the substrate;
a predetermined surface which faces a side surface of the substrate held on the holder via a predetermined gap and is liquid-repellent; and
a chamfered portion formed on an upper portion of the predetermined surface, wherein:
the side surface of the substrate is provided with a liquid-repellent area which is liquid-repellent, and
the chamfered portion is provided to face the liquid-repellent area of the substrate held on the holder.

2. The substrate holding device according to claim 1, wherein a depth of the chamfered portion is set according to the liquid-repellent area of the substrate.

3. The substrate holding device according to claim 1, wherein a lower end of the chamfered portion is set at a position higher than a lower end of the liquid-repellent area of the substrate.

4. The substrate holding device according to claim 1, further comprising a liquid-repellent upper surface

extending from the chamfered portion on the upper portion of the predetermined surface so as to be substantially flush with a surface of the substrate held on the holder.

5. The substrate holding device according to claim 4, wherein a thickness of the substrate is approximately 0.775 mm, and a depth of the chamfered portion is not more than 0.5 mm.

6. The substrate holding device according to claim 1, wherein a sum of a contact angle of the liquid-repellent area of the substrate with the liquid and a contact angle of the predetermined surface with the liquid is greater than 180 degrees.

7. The substrate holding device according to claim 1, wherein the liquid-repellent area is an area in which a liquid-repellent material is coated on a base material of the substrate.

8. The substrate holding device according to claim 1, wherein the predetermined gap is 0.1 to 0.5 mm.

9. The substrate holding device according to claim 1, wherein the predetermined surface is provided to surround the side surface of the substrate.

10. The substrate holding device according to claim 1, wherein no liquid-repellent area is formed on a back surface of the substrate.

11. The substrate holding device according to claim 1, wherein the chamfered portion is coated with a liquid-repellent material.

12. The substrate holding device according to Claim 1, wherein sectional shapes of an upper side portion and a lower side portion of the substrate are arced.

13. The substrate holding device according to Claim 1, wherein a chamfering angle of the chamfered portion is approximately 45 degrees.

14. An exposure apparatus comprising the substrate holding device as defined in any one of claims 1 to 13, and exposing a substrate held on the substrate holding device through a liquid.

15. A device manufacturing method comprising:
exposing a substrate by the exposure apparatus as defined in claim 14; developing the exposed substrate; and
processing the developed substrate.

16. An exposure method for exposing a substrate through a liquid, comprising:

making a side surface of the substrate face a predetermined surface having liquid-repellency via a predetermined gap; and

exposing the substrate through the liquid,

wherein a chamfered portion is formed on an upper portion of the predetermined surface, and a liquid-repellent area is provided on the side surface of the substrate so as to face the chamfered portion.

17. The exposure method according to claim 16, wherein the liquid-repellent area of the substrate is set according to a depth of the chamfered portion.

18. The exposure method according to claim 16, wherein the liquid-repellent area is set so that a lower end position of the liquid-repellent area of the substrate becomes lower than a lower end position of the chamfered portion.

19. The exposure method according to claim 18, wherein a distance between the lower surface position of the substrate and the lower end position of the liquid-repellent area is not less than 0.2 mm.

20. The exposure method according to claim 16, wherein a sectional shape of a first area including an upper portion of the side surface of the substrate is curved, a sectional shape of a second area under the first area is a plane, and the liquid-repellent area includes the first area and at least a part of the second area.

21. The exposure method according to any one of claims 16 to 20, wherein the liquid-repellent area is an area coated with a liquid-repellent material on a base material of the substrate.

22. A device manufacturing method comprising:
exposing a substrate by the exposure method as defined in claim 16, developing the exposed substrate, and processing the developed substrate.

23. A plate member used in an exposure apparatus which exposes a substrate held on a substrate holding device by irradiating a surface of the substrate with an exposure light beam through a liquid, the plate member comprising:

a predetermined surface which faces a side surface of the substrate held on the substrate holding device via a predetermined gap and which has a liquid-repellency; and

a chamfered portion formed on an upper portion of the predetermined surface,

wherein the chamfered portion is provided to face a liquid-repellent area on the side surface of the substrate held on the substrate holding device.

24. The plate member according to claim 23, wherein the plate member is held by sucking by the substrate holding device and is releasable.

25. The plate member according to claim 23, wherein a depth of the chamfered portion is set according to the liquid-repellent area of the substrate.

26. The plate member according to claim 25, wherein the depth of the chamfered portion is set according to a contact angle of the liquid-repellent area with the liquid.

27. The plate member according to claim 23, wherein a lower end of the chamfered portion is set at a position higher than a lower end of the liquid-repellent area of the substrate.

28. The plate member according to claim 23, further comprising a liquid-repellent upper surface extending from the chamfered portion on the upper portion of the

predetermined surface so as to be substantially flush with a surface of the substrate held on the holder.

29. The plate member according to Claim 23, wherein a sum of a contact angle of the liquid-repellent area of the substrate with the liquid and a contact angle of the predetermined surface with the liquid is greater than 180 degrees.

30. The plate member according to claim 23, wherein the predetermined gap is 0.1 to 0.5 mm.

31. A substrate holding device which holds a substrate to be exposed through a liquid, comprising:
a holder which holds the substrate; and
a predetermined surface which faces a side surface of the substrate held on the holder via a gap, wherein
the predetermined surface includes a flat portion which is substantially parallel to the side surface of the substrate held on the holder and a chamfered portion which extends to a position above the flat portion, and
a sum of a contact angle of the side surface of the substrate with the liquid and a contact angle of the flat portion of the predetermined surface with the liquid is greater than 180 degrees.

32. The substrate holding device according to claim 31, further comprising a liquid-repellent upper surface extending from the chamfered portion so as to be substantially flush with a surface of the substrate held on the holder.

33. The substrate holding device according to claim 31, wherein the flat portion of the predetermined surface is an area coated with a predetermined material on a base material of the substrate.

34. The substrate holding device according to claim 31, wherein the predetermined surface is provided to surround the side surface of the substrate.

35. The substrate holding device according to claim 31, wherein a chamfering angle of the chamfered portion is approximately 45 degrees.

36. The substrate holding device according to claim 31, wherein a thickness of the substrate is approximately 0.775 mm, and a depth of the chamfered portion is not more than 0.5 mm.

37. An exposure apparatus comprising: the substrate holding device as defined in any one of claims 31 to 36,

and exposing a substrate held on the substrate holding device through a liquid.

38. A device manufacturing method comprising:
exposing a substrate by the exposure apparatus as defined in claim 37; developing the exposed substrate; and processing the developed substrate.

39. A plate member used in an exposure apparatus which exposes a substrate held on a substrate holding device by irradiating an exposure light beam onto a surface of the substrate through a liquid, wherein:

the plate member has a predetermined surface which faces a side surface of the substrate held on the substrate holding device via a predetermined gap;

the predetermined surface includes a flat portion which is substantially parallel to the side surface of the substrate held on the holder and a chamfered portion which extends to a position above the flat portion; and

a sum of a contact angle of the side surface of the substrate with the liquid and a contact angle of the flat portion of the predetermined surface with the liquid is greater than 180 degrees.